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P A P E R

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C H E M I S T R Y.

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## CHEMISTRY.

The Thanks of the Society were given to the Rev. Mr. SWAYNE, of Pucklechurch, near Bristol, for the following Communication relative to the use of Oak Leaves, in Tanning.

S I R,

**K**NOWING that the Bark of the Oak was a chief material in the art of tanning Leather, and conceiving that every other part of that tree was fraught with the same astringent principle, through which the bark becomes so efficient in that art; the thought had often occurred, that the leaves might be advantageously applied for the same purpose. Having in my possession a quantity of those leaves, which had been collected on account of the galls attached to them, I was desirous of ascertaining the proportion of astringent matter contained in them, and of comparing it with that contained in the bark. It was  
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some time before I could think of a method of doing this; and whether the method I at length used was fully adequate to the intention, must be left to the determination of those who have more knowledge in chemistry than I can pretend to.

The well-known property which this astringent matter possesses, of uniting or striking a black colour, with the calx of iron, suggested to me that its quantity might probably be ascertained, by extracting this matter, through the medium of hot water in which it is known to be soluble, saturating the extract with a known weight of the calx of iron, and afterwards filtering, drying, and weighing it. Supposing martial vitriol to contain iron in a very proper state for this experiment, the first thing I had to do, was, to ascertain the weight of iron in a given weight of vitriol; and this I attempted by the following process: I weighed five pennyweights of vitriol; dissolved it in  
water;

water; and added a like weight of vegetable fixed alkali; which immediately precipitated the iron: the mixture was then thrown on a paper filtre, the weight of which was noted down; and, after being plentifully elutriated with hot water, the residue was dried and weighed. Its weight, exclusive of the filtre, was two pennyweights thirteen grains. This proportion of iron in martial vitriol, differs from that given by Professor Neumann, from his Analysis (See Lewis's translation of Neumann's Chemistry, Vol. I. p. 278); but it is necessary to mention, that the vitriol which I made use of had been kept in a dry place, uninclosed in a glass vessel, by which it had lost much of its water of crystallization; and this accounts for the difference. At the same time, and from the same parcel of vitriol, I weighed several other portions, for after-experiments.

The weight of iron, in a given weight of vitriol, being known, I then attempted  
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to follow the process above suggested; but, upon trial, found that the coloured particles were so minute or so intimately mixed, that they passed with the fluid through the filtre: this I attributed to the presence of the vitriolic acid, and its close attachment to the coloured particles. With a view, therefore, to destroy this suspected combination, by presenting to the acid a substance with which it has a nearer affinity, I added some mild salt of tartar, which instantly produced the desired effect, and brought on an entire separation of the coloured mass. I then went on with my intended experiments, in the following manner.

I took a half-peck measure full of dried oak leaves, well pressed down, from which I had before separated several ounces of mushroom galls, and having put them in a brass kettle, with a sufficient quantity of water, boiled them therein for two hours. The decoction was then poured from the leaves,  
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and fresh water added to them; this was likewise boiled for a considerable time, till it was judged that the water had extracted all the astringent matter: both decoctions were then boiled down, in the same kettle, to one gallon. In a certain measure of this concentrated extract, I dissolved five pennyweights of green vitriol, and afterwards added the like weight of salt of tartar: this mixture was then thrown on a filtre of sinking paper, (the weight of which was three pennyweights); and, after being perfectly elixated with hot water, the residuum was dried and weighed.

			Dwts.	Grs.
The filtre, with its contents,				
weighed	—	—	6	14
Subtract the weight of the				
filtre	—	—	3	0
			<hr/>	
			3	14
Subtract the calx of iron			2	13
			<hr/>	
There remains of astringent				
matter	—	—	1	1
			Two	

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Two pints of this reduced extract were still farther evaporated to one pint; and a like measure of this was treated as the former.

			Dwts.	Grs.
The filtre, with its contents,				
weighed	—	—	7	1
Subtract the filtre, which				
weighed	—	—	2	15
			<hr/>	<hr/>
			4	10
Subtract the calx of iron			2	13
			<hr/>	<hr/>
Remainder of astringent matter			1	21
			<hr/>	<hr/>

I then obtained from a tanner two pounds of oak bark, which was perfectly dry, and, after cutting it into thin shavings with a plane, boiled it in three portions of water for several hours, till, from the colour as well as the taste of the last decoction, the astringency seemed to be perfectly extracted. These several decoctions were added together, and evaporated to the same quantity as those of the leaves, namely,  
one



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one gallon. An equal measure of this, as above, produced by the like treatment, a residuum which, with its filtre, Dwts. Grs.

weighed	—		7	10
Subtract the filtre, which				
weighed	—	—	2	19
			<hr/>	
			4	15
Subtract the calx of iron			2	13
			<hr/>	
Remainder of astringent matter			2	2
			<hr/>	

A quart of this reduced extract was further concentrated to a pint, and an equal measure of this was treated as before.

			Dwts.	Grs.
The filtre, with its contents,				
weighed	—	—	9	12
Subtract the filtre, which				
weighed	—	—	2	15
			<hr/>	
			6	21
Subtract the calx of iron			2	13
			<hr/>	
Remainder of astringent matter			4	8
				These

These experiments do not exactly tally; since, in those with the leaves, the amount of astringent matter, in the second experiment, ought to have been double that of the first; and, in those with the bark, the astringent matter of the first experiment ought to have been half as much as that of the second. The supposition of a small inaccuracy in the weighing, or a small loss in the process of these experiments, will tend to reconcile them: where the error lay, in the first instance, I cannot pretend to guess. In the first experiment with the bark, the filtre caught fire while it was drying; and although it was extinguished almost immediately, yet there must have been a loss of some grains from it. Notwithstanding the experiments do not perfectly accord, yet I think we may fairly deduce from them, provided the method of trial be not objected to, that half a peck of leaves contain nearly as much astringent matter, as one pound of bark. Oak Bark was sold in this neighbourhood, last season,

son, for five guineas a ton. In its marketable state, it is by no means sufficiently dry for preservation; and the tanners are obliged to dry it more perfectly; and, at a considerable trouble and expence, they likewise get it cleaned from much extraneous matter. The loss of weight, from these operations, cannot, I should suppose, be estimated at less than twenty shillings per ton. What I mean is, that, if a ton of bark cost the tanner, in the first purchase, five guineas, the same weight of bark, when properly dried and cleaned, will stand him in six pounds five shillings: for the sake of easier calculation, we will say six pounds. I have heretofore had oak leaves collected for the purpose of making hot-beds for melons (for which they are excellent), at three-pence and four-pence per sack of four bushels, or thirty-two half pecks, which, according to the conclusion above, are equal to thirty-two pounds of bark. Thirty-two pounds of bark, at six pounds per ton, come to one shilling and

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eight-pence halfpenny and a fraction. If then my premises stand unimpeached, it will follow that the tanner might obtain as much astringent matter in leaves, for fourpence, as costs him in bark five times that sum : whether it would equally answer his purpose, remains to be proved. There would be undoubtedly much trouble, and some expence, in drying the leaves, which would be necessary, in order to preserve them ; and they would occupy much room. Perhaps for these reasons, the most economical plan would be, to obtain a concentrated extract from them, on or near the place where they should be collected, which might be conveyed and afterwards stored in casks. This likewise remains as the subject of experiment ; but, before leaves can in any way be legally used by the tanner, it is necessary that the act of parliament be repealed, which confines him to the use of Ash and Oak Bark : this restriction was probably laid, not solely from the belief that those substances were the most proper for  
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the purpose of tanning leather, but likewise to encourage the planting and nurturing of those valuable timber-trees. Be this as it may, at present it rather operates to their destruction, than preservation or increase; since the high price which oak bark now bears, proves an irresistible temptation with needy proprietors, to cut down their oaks before they arrive at a proper age for timber. Should oak leaves ever come in much request for tanning, this doubtless would prove an antidote to the rage of felling, and an effectual preservative of timber; since no one surely would ever think of felling his oaks prematurely, whilst they yielded him an annual profit by standing.

I am,

Your most obliged humble servant,

GEORGE SWAYNE.

*N.B.* The vitriol was in every case sufficient to saturate the astringent matter, and the quantity of salt of tartar sufficient for the acid.